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ABSTRACT

The increased computer capability at the University of Chicago challenges its Computation Center to generate demand by making the expanded capacity available in a broader, more effective way than has been done in the past. The new computing services must be of reasonable comparable quality to alternatives, but offered at lower marginal costs. The decision to expand services by purchasing compatable larger systems was made in 1973 by the University Board of Computing Activities and Services. It was decided that the marginal cost of wholesale acquisition of blocks of time from major centers off campus would be greater than the marginal cost of acquisition of the next larger system for the center. (WCM)

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Computing Services at Chicago

by Fred H. Harris
The University of Chicago

The University of Chicago is a private, nondenominational, coeducational institution of higher learning and research which puts equal emphasis on research and teaching. It has approximately 7,500 students, of whom 2,100 are in the undergraduate college and the rest are enrolled in the four graduate divisions and seven professional schools. The University of Chicago has attracted a strong independent faculty of international distinction which numbers approximately 1,100, and there are a comparable number of research associates, lecturers, field workers, and other supporting professionals.

The Computation Center at the University of Chicago is a centralized activity with responsibilities for providing computer-related services on a cost recovery fee basis for research, instructional, and administrative purposes. Income for services rendered, whether from grants and contracts or from the University budget, is derived from discretionary monies which the responsible individual may allocate to other purposes. While the University community is in some ways a constrained marketplace, alternatives to the use of the Center's services do exist and are used. Thus the Center is expected to offer a broad range of services on a competitive basis. Increasingly, University computing services must be of reasonably comparable quality to alternatives but offered at lower marginal costs.

Cost recovery is a basic operating policy of the Center, and the desire to

retain maximum support from external funding sources is a strong one. The University administration and Board of Computing Activities and Services has traditionally rejected the concept of free access. However, several years ago when external support of computing declined, the University increased its support to Computer user groups through the regular budget and continued to underwrite a deficit computer center operation with a direct subsidy. In the academic year 1972-73 sources of income to the computer center by percentage were: 21% from government and private grants and contracts; 77% from the University; and 2% from other external sources. Figure 13.2 shows sources of funding for each of three years 1970-71 through 1972-73. On the average, annual expense for the Center over the last several years has approached 4% of the University's general academic budget. Few universities support their computing centers to this extent.

Since it opened in the fall 1962 with an IBM 7090, the Computation Center has successively used an IBM 7094 coupled with a 7040, an IBM 360 Model 50, IBM 360 Model 65, and has recently installed IBM 370 Model 168. The Center traditionally has offered batch processing services with emphasis on turnaround as a function of price-related priority and resource requirements. Over the years access has been made more convenient through the addition of high-speed remote job entry stations and low-speed remote job entry facilities such as WYLBUR. A special priority was also implemented several years ago for nonsetup jobs with limited core and CPU requirements like student debugging tasks. Typically turnaround time for this type of job is extremely good. The resulting service, as viewed by the user, is illustrated by turnaround data, the relative use of high and low priority and the growth in use of remote job entry stations and online disk storage. Figures 13.3 through 13.6 illustrate the trend of these indicators from July 1970 through June 1973. To make the computer even more accessible, the Center will be implementing time-sharing services in 1974.

After considering several alternatives for future access to computing resources, the University Board of Computing Activities and Services decided in 1973 that it could best expand services over the existing base of support by purchasing a compatible larger computer system.

The marginal cost of wholesale acquisition of blocks of time from major centers off campus would be greater than the marginal cost of acquisition of the next larger system for the Center.

Finally, in the judgment of the Board it will be at least five years before computing networks of the ARPA type will be available on a viable service basis with organizational and funding problems resolved. The University's decision to amortize the 370/168 over ten years sheds additional light on the Board's estimate of when new alternatives with major improvements in cost effectiveness will be available. Our justification analysis indicated that

Figure 13.2 Computation Center
Sources of Funding

SOURCES OF FUNDING	FY 1970 - 71	FY 1971 - 72	FY 1972 - 73
Restricted Accounts (Government)	23.7%	16.5%	15.6%
Restricted Accounts (Non Government)	6.0	6.5	5.2
Subtotal	29.7%	23.0%	20.8%
University Budget	54.1%	70.7%	69.0%
Deficit	12.7	3.0	8.2
Subtotal	66.8%	73.7%	77.2%
External Accounts (Academic)	2.3%	2.2%	1.7%
External Accounts (Commercial)	1.2	1.1	.3
Subtotal	3.5%	3.3%	2.0%

Figure 13.3 Median Hours Turnaround by Month

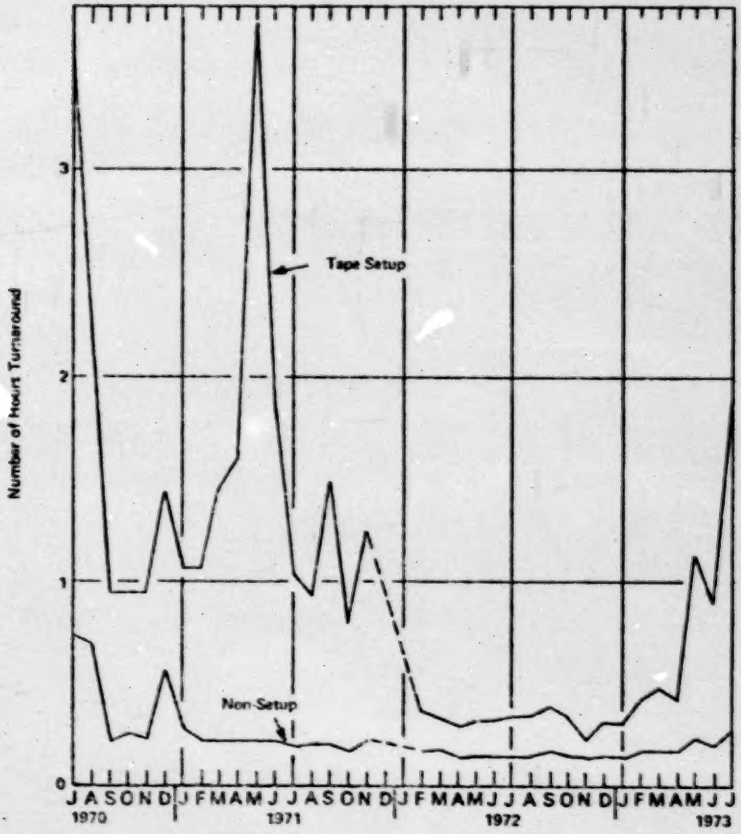


Figure 13.4 Relative Use of Low and High Priority on the 360/65 (Billable Usage Only)

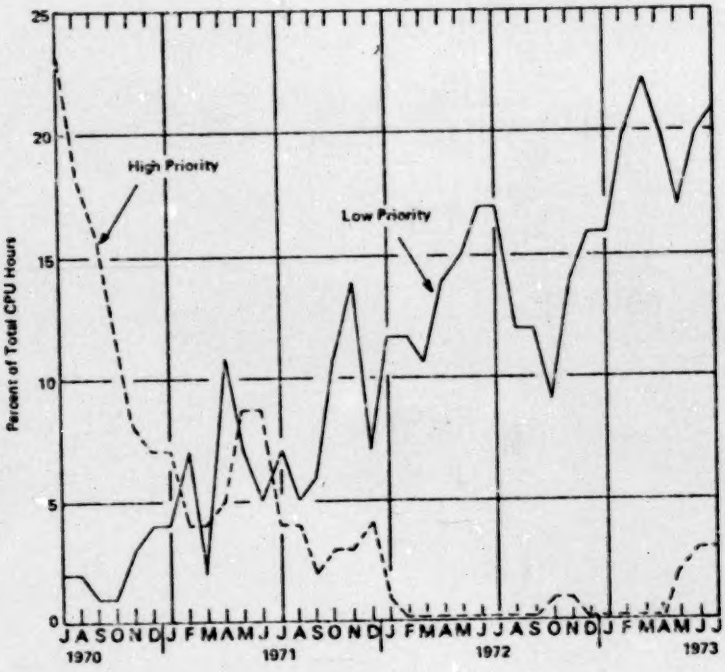

Percent of Total CPU Hours
25
20
15
10
5
0
High Priority
Low Priority
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J
1970
1971
1972
1973

Figure 13.5 Jobs Submitted Via RJE

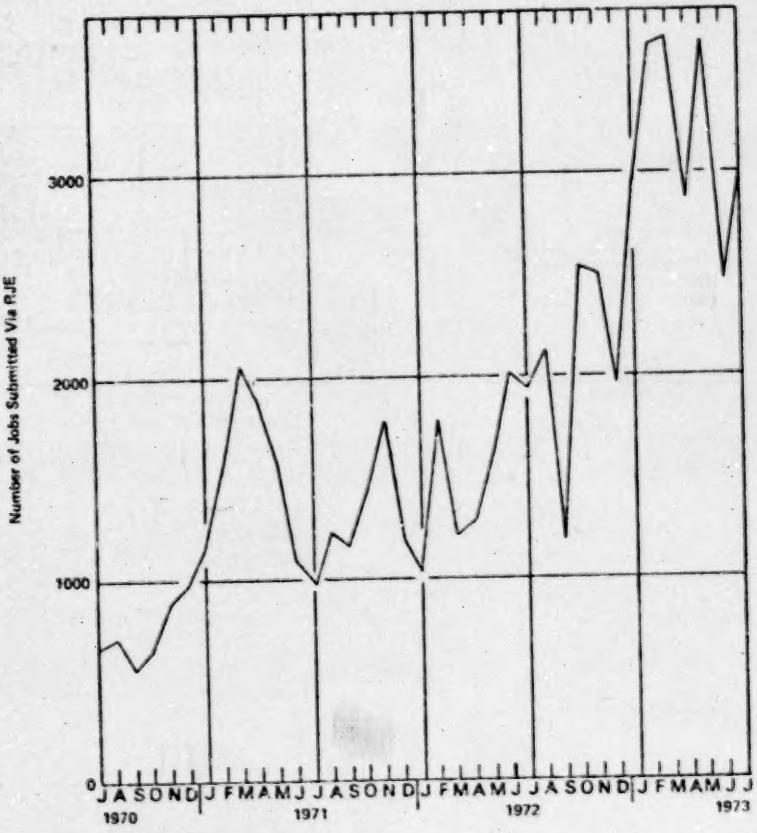
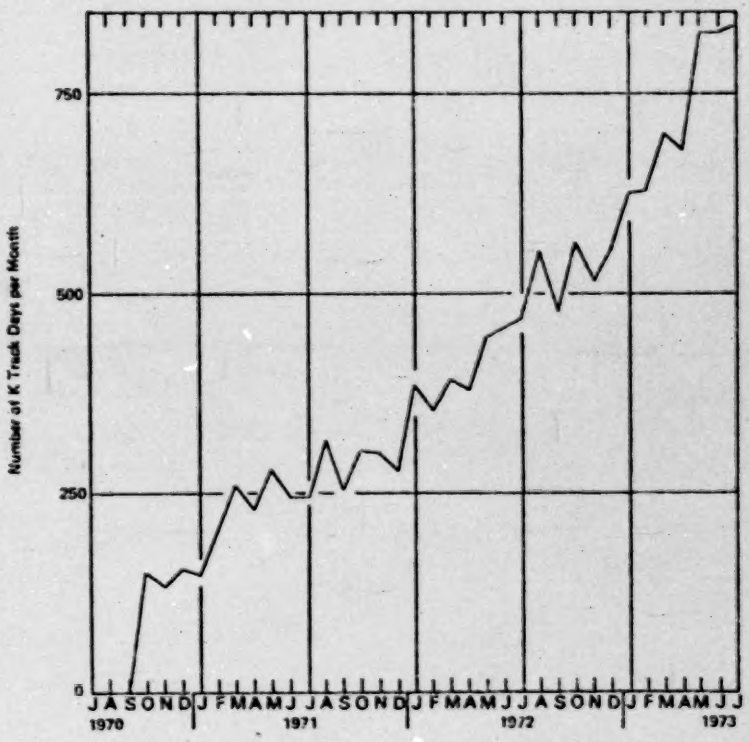


Figure 13.6 Days per Month in Which Online Disc Storage Exceeded 1000 Tracks



the 370/168 will provide the University with four- to six-fold increase in capacity for less than 10 percent increase in expense. No such price performance was available from other sources with the capacity to handle an equivalent workload. There are more than 50 laboratory minicomputers as well as several divisional computer facilities on the University of Chicago campus. Use of the minicomputers for laboratory equipment control and data acquisition will, and should, continue without conflict with the Center's services. Through a hierarchical approach to integrating and interfacing these minicomputers with the Center, (See Chapter 4) any general-purpose computation now being done on these systems should shift back to the Center.

The challenge which now faces the Computation Center is to aid in generating the demand by making the expanded capacity available in a broader, more effective way than has been done in the past. Algorithms now being considered for that purpose include: an expansion of the three-priority differential pricing system to at least a five-priority scheme; provision of volume discounts as a function of fixed commitments; and provision of matching University funds for increased external funds above some negotiated base level. While encouraging use of the Computation Center, the University administration wants to avoid wherever possible the image of undue constraints and is sensitive to the economic paradoxes of centralized functions operating with charge-back policies in decentralized environments. The uneconomic alternatives which may arise from the viewpoint of a decentralized unit are very real, and the University is turning to marginal cost analysis to resolve such conflicts. Additional budgetary support may be appropriate in individual cases.

The Board of Computing Activities and Services believes that this approach to providing major computing resources is a sound one. It effectively balances the demand for computing resources, at reasonable costs, with the other needs of the University.